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APPLICATION FOR UNITED STATES LETTERS PATENT

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FOR: OUTER SURROUNDING BODY FOR USE IN CONSTRUCTION, AND APPARATUS FOR MANUFACTURING THE SAME

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DESCRIPTION

OUTER SURROUNDING BODY FOR USE IN CONSTRUCTION, AND APPARATUS FOR MANUFACTURING THE SAME

TECHNICAL FIELD

The present invention relates to an outer surrounding body such as a roof, wall or the like which is worked as a sheet for use in construction by covering the surface of a thin metal sheet with a synthetic resin film, in which waterproofing and water-tightness are improved in the locations where the construction sheets are connected to each other or the mounting locations of trough members, and the working characteristics and finish are greatly improved, and also relates to an outer surrounding body for use in construction and a manufacturing apparatus for the same which make it possible to achieve an extremely good finish in terms of waterproofing and water-tightness regardless of the degree of experience of the workers.

BACKGROUND ART

In the past, there have commonly been problems in areas of heavy snow accumulation of the joint parts (connecting parts) of roofs becoming immersed in water, thus causing leakage such as ceiling leakage or the like to occur. In recent years, furthermore, because of the popularization of verandah roofs, there has been an increase in cases where

roofs become immersed in water due to the cultivation of plants and the like, so that a demand has arisen for roofs with an even higher degree of water-tightness. Furthermore, a patent reference (Japanese Patent Application Laid-Open No. 7-150703) exists which indicates a connecting structure that is used to connect roofing sheet members to each other. In this structure, bent parts that are used for connection are formed on both sides of flat roofing sheets in the lateral direction, and these bent parts are connected to each other in a bent form.

In the abovementioned patent reference, invasion by rain water or the like can be checked to some extent by fastening the connecting bent parts of adjacent roofing sheet members to each other. Furthermore, connecting parts of construction sheets include various types of connecting parts, such as parts that are fastened together, parts that are engaged and the like. In most cases, however, in order to achieve more complete waterproofing and obtain a higher degree of water-tightness, a filling type sealing material is mounted in the locations where adjacent roofing sheets are connected to each other. In the case of long-term use, however, such sealing materials lose flexibility and elasticity, so that cracking and peeling occur in the locations where connections are made, thus forming gaps so that the water-tightness gradually deteriorates. For such reasons, a considerable degree of

uneasiness remains in filling type sealing materials in terms of security and reliability.

Accordingly, resin welding has also been used in recent years. However, this resin welding is a process in which a hot air draft is blown onto the connecting parts during working, so that a resin welding material is melted. Accordingly, working is performed so that the connecting locations are filled with a molten resin material while this resin material is melting at a high temperature. This high temperature that is generated causes local thermal strain of the parts that are subjected to this high temperature. Deformation of the construction sheets caused by this thermal strain is deemed to produce an unacceptable finish, and the thermal welding materials also fail to have a clean finish, leading to a conspicuous deterioration in the external appearance. Furthermore, if such high temperatures must be used, it is likewise impossible for the resin welding materials to achieve a sufficiently close affinity with the surface of the metal roof, so that good resin welding cannot be performed.

Accordingly, it is conceivable that a high degree of water-tightness might be achieved by injecting a molten resin into the abovementioned connecting parts by resin welding.

However, even if direct resin welding is performed on thin metal plates or coated steel plates, a strong adhesion is

not obtained. In other words, the components of the welding material and the surface of the member being welded must be the same. Furthermore, in cases where the core part is a thin metal sheet, the heat that is absorbed during welding escapes more readily via the metal sheet (than it does in the case of thin metal sheet part covered by a synthetic resin), so that it is necessary to slow the running of the welding apparatus by 10% or more in order to elevate the temperature to a specified temperature.

In such resin welding means, a hot air draft is blown onto the locations of the connecting parts, so that these locations are heated to a high temperature; at the same time, welding is performed by extruding the resin welding material while melting this material. In order to perform this resin welding, an apparatus for feeding out the resin welding material and a hot air draft generating apparatus for heating the area around the welding location must be provided. Since this resin welding is performed with the speed at which the welder is moved, the amount of resin welding material that is fed out and the like constantly maintained at appropriate values, this has a great effect on the resin welding finish. Accordingly, in the case of resin welding, an experienced technique is required to some extent, so that the acceptability of the finish is determined by the experience of the worker.

Specifically, in the case of an experienced worker, the resin welding can be finished in an extremely clean state. However, in the case of an inexperienced worker, the following problem arises: namely, the filling state of the resin welding is uneven, and the hot air draft apparatus may be applied too strongly so that the surrounding area is melted to a greater extent than necessary, thus causing melting of the resin layer covering the roofing sheet member, so that the underlying metal is exposed, and the resin layer can no longer perform the function of a protective film, or it may become impossible to reach the temperature required for the favorable performance of resin welding in the areas surrounding the welding locations, so that sufficient and secure resin welding cannot be performed.

It is an object of the present invention to achieve favorable waterproofing and water-tightness in the locations where construction sheets are connected to each other as described above, to achieve favorable finishing in these locations, to improve the welding characteristics using steel sheets covered with the same components as the welding material, and to make it possible to perform resin welding with an extremely good finish by setting the areas around the connecting locations at an appropriate temperature and filling the connecting locations with an appropriate amount of the

welding material, regardless of the degree of experience of the worker.

DISCLOSURE OF THE INVENTION

In the present invention, in order to solve the abovementioned problems, a plurality of construction sheets in which a thin metal sheet part and a synthetic resin film are constructed in layer form, and each sheet consists of a main sheet, an overlapped part which is formed on one side of this main sheet in the lateral direction, an overlapping part which is formed on the other side of the main sheet in the lateral direction, and which can overlap with the abovementioned overlapped part, and a fastening part which is formed in a substantially flat shape from the outside end of the abovementioned overlapped part, are disposed side by side, a portion of the main sheet of one construction sheet that is located near the overlapping part is placed on the fastening part of an adjacent construction sheet and the overlapping part is overlapped with the abovementioned overlapped part, and an area extending from the vicinity of the outer ends of the overlapping parts of both construction sheets to the vicinity of the inside corner parts of the overlapped parts is fused with said synthetic resin film via a resin welding member, thus producing effects such as reducing the occurrence of deformation in response to thermal strain caused by locally high temperatures in the outer surrounding body worked as a

construction member that is formed by covering the surface of a thin metal sheet with a synthetic resin film, improving the finish of the resin welding and the like.

Furthermore, in the present invention, it is possible for the bent end edges to support the main sheets of the adjacent construction sheets from the back side in a state in which the overlapped parts and overlapping parts of the adjacent construction sheets are overlapped, by forming a construction outer surrounding body in which bent end edges are folded back above from the outside ends of the abovementioned fastening parts in the invention described above. Accordingly, the fastening parts can be prevented from contacting the head parts or the like of the fastening fittings that are fastened to the underlying parts, and a stable connected structure of the adjacent construction sheets can be obtained.

Furthermore, in the present invention, it is possible to improve the working efficiency by forming a construction outer surrounding body in which engaged parts are formed in the abovementioned overlapped parts, engaging parts are formed in the abovementioned overlapping parts in positions corresponding to the abovementioned engaged parts, and the abovementioned engaged parts and engaging parts are engaged and fastened, in the two inventions described above.

Furthermore, in the present invention, it is possible to achieve an extreme simplification of the water-tight mounting

between the eave and trough member by forming a construction outer surrounding body in which an eave location in the end part of the abovementioned construction sheet in the longitudinal direction and a trough member formed by constructing a thin metal sheet part and a synthetic resin film into layer form are fused with the abovementioned synthetic resin film via the abovementioned resin welding member in the three inventions described above.

Furthermore, in the present invention, it is possible to obtain a construction outer surrounding body in which the fusion of the resin welding member and the synthetic resin film is favorably performed, the finish is extremely clean and favorable, and the waterproof seal possesses durability, by forming a construction outer surrounding body in which the chief component of the abovementioned synthetic resin film is a thermoplastic resin, in the four inventions described above.

Furthermore, in the present invention, it is possible to obtain resin welding with an extremely good finish in the connection locations (connecting parts) of the adjacent construction sheets, regardless of the degree of experience of the worker, so that the connection locations can be given more secure water-tightness and air-tightness, by constructing a construction outer surrounding body manufacturing apparatus comprising a resin welder part which is constructed from a car part equipped with a running part that is caused to rotate by

a driving part, a welding member feeding apparatus which feeds out the molten resin welding member, and a hot air blast apparatus which heats the connection locations (connecting parts) of the abovementioned adjacent construction sheets, in an apparatus in which a plurality of construction sheets in which a thin metal sheet part and a synthetic resin film are constructed in layer form, and each sheet has a main sheet, an overlapped part which is formed on one side of this main sheet in the lateral direction, an overlapping part which is formed on the other side of the main sheet in the lateral direction, and which can overlap with the abovementioned overlapped part, and a fastening part which is formed in a substantially flat shape from the outside end of the abovementioned overlapped part are disposed side by side, and resin welding is performed in the connecting parts where the overlapping parts are caused to overlap with the overlapped parts.

Furthermore, in the present invention, the connection locations of adjacent construction sheets can be filled with a molten resin welding member while being tightened, so that a good finish can be obtained, by constructing a construction outer surrounding body manufacturing apparatus in which a finishing roll part comprising a tightening roll that tightens the connection locations of the adjacent construction sheets, and a supporting roll, is mounted on the abovementioned car part.

Furthermore, in the present invention, the manufacturing apparatus B of the present invention can be accurately moved along the connection locations (connecting parts) of adjacent construction sheets, so that the filling of the molten resin welding member can be accomplished with a much more accurate and favorable finish, by constructing a construction outer surrounding body manufacturing apparatus in which a guide ring which is disposed on the top of the connection locations of the abovementioned construction sheets that are adjacent in the forward-rearward direction is provided on the abovementioned car part.

Furthermore, in the present invention, the planning of the work of resin welding by means of the manufacturing apparatus can be accomplished with good efficiency by constructing a construction outer surrounding body manufacturing apparatus in which the abovementioned resin welder part can be freely set in an appropriate position along the vertical direction with respect to the car part.

Furthermore, in the present invention, a clean resin welding surface can be obtained by constructing a construction outer surrounding body manufacturing apparatus in which a feed-out nozzle that feeds out athe abovementioned resin welding member to the connection locations (connecting parts) of said adjacent construction sheets is mounted in the welding

member feeding apparatus of the abovementioned resin welder part, and a molding surface is formed in this feed-out nozzle.

Furthermore, in the present invention, the surface shape of the resin welding member can be made polyhedral, and in particular, a structure can be obtained in which the thickness gradually increases in the downward direction in the connection locations (connecting parts), so that the connecting strength in the connection locations (connecting parts) can be greatly improved, by constructing a construction outer surrounding body manufacturing apparatus in which the abovementioned molding surface has a substantially polyhedral shape.

Furthermore, in the present invention, by constructing a construction outer surrounding body manufacturing apparatus in which a pressing part that presses the main sheets in the vicinity of the connection locations of the adjacent construction sheets is mounted in the feed-out part of the abovementioned welding member feeding apparatus, it is possible to press the main sheets in the vicinity of the connection locations of the adjacent construction sheets by means of this pressing part, so that the areas in the vicinity of the connection locations (connecting parts) can be stabilized in the resin welding work, thus making it possible to prevent vertical deviation in the connection locations (connecting parts) of the adjacent construction plates, so

that resin welding with an extremely good finish can be performed.

Furthermore, in the present invention, resin welding with a good finish can be obtained by constructing a construction outer surrounding body manufacturing apparatus in which the running ring of the abovementioned running part consists of a front ring part and a rear ring part, and both the abovementioned front ring part and rear ring part are rotationally driven by the abovementioned driving part.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A is a partially cut-away perspective view of essential parts of an outer surrounding body formed by working construction sheets of the first type of the present invention;

Fig. 1B is a an enlarged longitudinal sectional front view of the area in the connection locations of adjacent construction sheets of the first type;

Fig. 2A is a schematic sectional view of a construction sheet of the first type;

Fig. 2B is an enlarged view of portion a in Fig. 2A;

Fig. 2C is an enlarged view of portion b in Fig. 2A;

Fig. 2D is an enlarged view of portion c in Fig. 2A;

Fig. 2E is a process diagram showing the placement of a portion of the main sheet (near the overlapping part) of one adjacent construction sheet on the fastening part of another adjacent construction sheet;

Fig. 3A is a perspective view showing the state in which resin welding is performed by the running type resin welder;

Fig. 3B is an enlarged view of essential parts showing the state in which resin welding is performed by the running type resin welder;

Fig. 3C is an enlarged view of essential parts showing the state in which resin welding is performed by the spray nozzle in the connection locations of the adjacent construction sheets;

Fig. 4A is an enlarged sectional view of the connection locations of the construction sheet of the second type of the present invention;

Fig. 4B is an enlarged sectional view of the overlapped part of the construction sheet of the second type;

Fig. 4C is an enlarged sectional view of the overlapping part of the construction sheet of the second type;

Fig. 5A is an enlarged sectional view of the connection locations of the construction sheet of the third type of the present invention;

Fig. 5B is an enlarged sectional view of the overlapped part of the construction sheet of the third type;

Fig. 5C is an enlarged sectional view of the overlapping part of the construction sheet of the third type;

Fig. 6A is an enlarged sectional view of the connection locations of the construction sheet of the fourth type of the present invention;

Fig. 6B is an enlarged sectional view of the overlapped part and suspension element of the construction sheet of the fourth type;

Fig. 6C is an enlarged sectional view of the overlapping part of the construction sheet of the fourth type;

Fig. 7A is a partially cut-away perspective view of essential parts showing the state in which the trough member of the first type is mounted in the construction outer surrounding body of the present invention;

Fig. 7B is a partially abbreviated longitudinal sectional side view showing the state in which the trough member is mounted in the construction outer surrounding body;

Fig. 8A is plan view of essential parts showing the attachment structure of the trough member at the eave location and the resin welding location;

Fig. 8B is a perspective view showing the eave end part location in the longitudinal direction of the construction sheet;

Fig. 8C is a longitudinal sectional side view of essential parts showing the state in which the trough member of the second type is mounted in the construction outer surrounding body of the present invention;

Fig. 8D is a perspective view of the trough member of the second type;

Fig. 9A is a perspective view showing the state in which resin welding is performed by the running type resin welder;

Fig. 9B is a side view of the running type resin welder;

Fig. 10A is a side view showing a state in which the resin welder part of the running type resin welder is set in a substantially vertical upper position;

Fig. 10B is perspective view of the running type resin welder as seen from below;

Fig. 11A is a front view of the running type resin welder;

Fig. 11B is a back view of the running type resin welder;

Fig. 12A is a perspective view of essential parts of the resin welder part;

Fig. 12B is side view of essential parts showing the state in which the pressing part is mounted in the resin welder part;

Fig. 13A is a sectional front view showing the operating state of the resin welder part and pressing part;

Fig. 13B is a plan view of the resin welder part and pressing part;

Fig. 14A is a perspective view of essential parts of the resin welder part of the type in which the molding surface is formed as a circular arch form surface;

Fig. 14B is a longitudinal sectional front view showing the operating state of the type in which the molding surface is formed as a circular arc form surface;

Fig. 15A is a bottom view of the car part;

Fig. 15B is an enlarged view of part a in Fig. 15A; and

Fig. 15C is a operating diagram showing the state in which the overlapped part and overlapping part are tightened by the tightening roll and supporting roll.

BEST MODE FOR CARRYING OUT THE INVENTION

Embodiments of the present invention will be described below with reference to the attached figures. First, the raw materials that form the construction sheet A will be described. These raw materials comprise a thin metal sheet part m_1 that is covered by a synthetic resin film m_2. These raw materials are formed into a construction sheet A such as a roofing sheet member, wall sheet member or the like by means of a roll molding machine, and construction outer surrounding bodies used as various building structures such as roofs, walls or the like can be worked using this construction sheet A.

A concrete example of this thin metal sheet part m_1 is a band-form sheet that is long in the longitudinal direction; for instance, a steel member such as a plated steel sheet, colored steel sheet, stainless steel sheet or the like, or a non-ferrous metal member such as an aluminum member, titanium member or the like may be used. This thin metal sheet part m_1

a thickness that allows molding by means of a roll molding chine; the thickness of this thin metal sheet part m_1 is approximately 0.3 mm to approximately 1.5 mm, and is even more preferably approximately 0.5 mm to approximately 1 mm.

Next, the synthetic resin film m_2 may consist of a synthetic resin of an appropriate type; however, it is desirable that this be a material that can be fused (or welded) to the resin welding member 8 described later. Furthermore, the chief component of this synthetic resin film m_2 may be a thermoplastic resin in some cases. In concrete terms, this consists of a synthetic resin whose chief component is a resin that has thermoplastic properties such as a vinyl chloride resin, olefin type thermoplastic elastomer or the like. The thickness of this synthetic resin film m_2 is in the range of approximately 0.1 mm to approximately 1 mm, more preferably in the range of approximately 0.2 mm to approximately 0.5 mm, and is even more preferably approximately 0.25 mm.

Furthermore, a film that has durability is ideal as the synthetic resin film m_2. Moreover, the setting of the melting temperature also varies according to the material; however, it is desirable that this melting temperature be set so as to correspond to the use conditions of the construction sheet A. Furthermore, construction sheets A that satisfy the abovementioned conditions also include vinyl chloride steel sheets (ordinarily called "PVC steel sheets"). Moreover,

materials which are superior in terms of weather resistance, with a strong resistance to ultraviolet light and contaminated air, and which tend not to show rupture, swelling, cracking or the like, are desirable as the synthetic resin film m_2. Concrete examples of desirable materials that satisfy the abovementioned conditions include olefin type thermoplastic elastomers consisting chiefly of ethylene-propylene or the like.

Furthermore, from the standpoint of environmental protection, it is desirable that the components that form the abovementioned synthetic resin film m_2 be constructed from compounds that do not contain any halogens. Specifically, it is desirable that chlorine type chemical substances be excluded from the components making up the synthetic resin film m_2, and that this synthetic resin film not be a film that is formed on the basis of organic chlorine compounds. As a result, even if discarded, the synthetic resin film m_2 will not generate dioxins, and will have no harmful effects on the environment or on living things.

The synthetic resin films m_2 can be fused to each other by melting the films (by blowing a hot air blast at around 500°C onto the films), and then pressing the films together following this heating. Furthermore, fusion (welding) with the resin welding member 8 can also be favorably performed by melting the same resin as the film inside a heating vessel,

and extruding this resin on top of the synthetic resin film m_2. It is sufficient if the resin welding member 8 is a material that possesses thermoplastic properties; however, it is desirable that this member consist of the same material as the abovementioned synthetic resin film m_2.

The construction sheet A is a sheet that forms roofs, walls and the like, and a plurality of different types of such sheets exist. As a basic configuration, all of these respective types of sheets are constructed from a main sheet 1, an overlapped part 2, an overlapping part 3 and a fastening part 4. The construction sheet A is formed so that the abovementioned synthetic resin film m_2 constitutes the front surface side of the main sheet 1, overlapped part 2, overlapping part 3, and fastening part 4. First, in the case of the construction sheet A of the first type, the overlapped part 2 is formed on one end of the flat main sheet 1 in the lateral direction as shown in Fig. 2A.

As is shown in Fig. 2C, this overlapped part 2 is a part that is caused to rise upward as seen from the main sheet 1, and is formed with a folded-back cross-sectional shape substantially similar to that of a hairpin. Furthermore, the rising part of the overlapped part 2 on the side of the main sheet 1 constitutes an inside part 2a, while the rising part on the outside of the overlapped part 2 constitutes an outside part 2b. The location of the bend between the main sheet 1

and the inside surface 2a of the abovementioned overlapped part 2 constitutes a corner part K. This corner part K is a location to which the resin weld part or place where resin welding is performed together with the abovementioned overlapping part 3 is in close proximity.

Next, a fastening part 4 is formed running toward the outside of the construction sheet A in the lateral direction, on the outside of the lower end of the outside part 2b of the overlapped part 2. The location where this fastening part 4 and the abovementioned outside part 2b are connection is a position that is beneath or lower than the main sheet 1. Specifically, the fastening part 4 has a slight step with the abovementioned main sheet 1. Furthermore, the abovementioned fastening part 4 constitutes a horizontal flat surface that is substantially parallel to the main sheet 1. The dimension of the fastening part 4 in the lateral direction (which is equal to the dimension of the construction sheet A in the lateral direction) is much smaller than the dimension of the main sheet 1 in the lateral direction.

The dimension of the construction sheet A in the lateral direction is approximately 3 meters to 6 meters; within this dimension, it is sufficient if the dimension of the fastening part in the lateral direction is set so that this dimension does not substantially exceed 30 millimeters. However, this dimension may be appropriately set as desired. This fastening

part 4 has the function of fastening the construction sheet A to the underlying part 5 via a fastening fitting 12. A bent end edge 4a with a shape that is folded back over the fastening part 4 (on the side of the front surface of the fastening part 4) is formed on the outer end of the fastening part 4. In concrete terms, furthermore, the part that connects the fastening part 4 and bent end edger 4a is formed with a substantially C-shaped or reverse C-shaped cross section.

Next, as is shown in Fig. 2D, the overlapping part 3 is formed on the side of the other end of the abovementioned main sheet 1 in the lateral direction, i. e., on the opposite side from the side on which the abovementioned overlapped part 2 is formed. In this overlapping part 3, an inside part 3a is formed in a rising configuration from the other end of the main sheet 1 in the lateral direction, and an outside part 3b is formed toward the outside from the upper end of this inside part 3a. The place where the inside part 3a and outside part 3b are connected has a substantially circular arc form or arch form cross-sectional shape, and the inside part 3a and outside part 3b are smoothly connected to each other at the tip. The overlapping part 3 overlaps with the overlapped part 2 of another adjacent construction sheet A.

Furthermore, an engaged part 2c is formed on the abovementioned overlapped part 2, and an engaging part 3c is

formed on the abovementioned overlapping part 3. Moreover, in construction sheets A, A, ... that are lined up side by side, a portion of the main sheet of the overlapping part 3 of each construction sheet A near the overlapping part 3 of this construction sheet A is placed on the overlapped part 2 of another adjacent construction sheet A, and the abovementioned engaged part 2c and engaging part 3c are engaged and fastened, so that the overlapping part 3 is overlapped on the abovementioned overlapped part 2. Each engaged part 2c is formed as a recess in the inside part 2a of the abovementioned overlapped part 2. In concrete terms, this part is bent into a cross-sectional shape having substantially the form of a reversed "V" from the area above the inside part 2a on the side of the main sheet 1, and the abovementioned inside part 2a has an inclined shape from the lower end of the portion that is bent into a reversed "V" shape, and is connected to the side of the main sheet 1.

The abovementioned engaged part 2c constitutes the lower end of the abovementioned shallow "V" shape. Next, the engaging part 3c is formed on the outside part 3b, and constitutes the pointed part of a part that is bent into substantially a shallow "V" shape toward the main sheet 1 at the lower end position of the outside part 3b. The shape of the outside part 3b from the outside part 3b to the engaging part 3c is an inclined shape that is oriented downward and

toward the outside. Furthermore, the system is arranged so that when the overlapping part 3 is overlapped with the overlapped part 2 in adjacent construction sheets A, A, the engaging part 3c can be simultaneously engaged with the engaged part 2c.

A plurality of the abovementioned construction sheets A are lined up side by side in the lateral direction. Then, as is shown in Fig. 2E, the fastening part 4 of one adjacent construction sheet A is fastened to the underlying part 5 via fastening fittings 12 such as screws or the like. The overlapping part 3 of another construction sheet A is overlapped with the overlapped part 2 of this first construction sheet A. In this case, the main sheet 1 in the vicinity of the overlapping part 3 is placed on the fastening part 4 that is formed as a continuation of the abovementioned overlapped part 2. In particular, in cases where a bent end edger 4a is formed on the outer end of the fastening part 4, the back surface of the main sheet 1 of the adjacent construction sheet A contacts the top part of the abovementioned bent end edge 4a. In this state, as is shown in Fig. 1B, the configuration can be arranged so that the head parts of the fastening fittings 12 such as screws or the like that fasten the fastening part 4 to the underlying part 5 do not contact the main sheet 1. Furthermore, deformation of the main sheet 1 by accumulated snow can be prevented.

Resin welding is performed on the corner part K constituting the corner location of the overlapped part 2 of one adjacent construction sheet A and the nearby main sheet 1, as far as the vicinity of the lower part (lower end T) of the outside part 3b of the abovementioned overlapping part 3. In concrete terms, the synthetic resin film m_2 in the location of the corner part K of the overlapped part 2 and the resin film m_2 in the location of the lower end T of the outside part 3b of the overlapping part 3 are fused (melted) by the performance of resin welding via the abovementioned resin welding member 8. In the resin welding work of fusion accomplished by means of this resin welding member 8, a hot air blast is caused to strike an area centered on the abovementioned corner part K and lower end T as shown in Fig. 3C. As a result, in the resin welding work performed on the overlapped parts 2 and overlapping parts 3 of the construction sheets A, local thermal deformation caused by the hot air blast tends not to occur.

A running type resin welder B is used in the resin welding work. As is shown in Fig. 3A, this running type resin welder B runs by means of car wheels, and a running motor is mounted in the body of this car. Furthermore, a welding member feeding apparatus 10 and a hot air draft apparatus 11 are mounted on this car body. A hot air draft is blown onto the location of the overlapped part 2 and overlapping part 3

from the spray nozzle 11a of this hot air draft apparatus 11, and this location is filled with the resin welding member 8 from the abovementioned welding member feeding apparatus 10 while being heated to a high temperature. In this case, as is shown in Fig. 3B, the system is arranged so that the hot air draft from the spray nozzle 11a strikes the corner part K of the abovementioned overlapped part 2 and the lower end T of the overlapping part 3, thus making it possible to fill the location of the corner part K and the location of the lower end T with the molten resin welding member 8. Furthermore, the resin welding member 8 is fused with the respective synthetic resin films m_2 of the abovementioned overlapped part 2 and overlapping part 3, so that the resin welding member 8 and synthetic resin films m_2 are fastened into an integral unit, thus making it possible to form the overlapping area between the overlapped part 2 and the overlapping part 3 into a waterproof structure.

The blowing of a hot air draft is not necessarily required in this resin welding; however, some type of preheating is desirable in order to improve the welding capacity and welding quality. Furthermore, it would also be possible to use a manual type resin welder instead of the abovementioned running type resin welder. This manual type resin welder is a handy type welder that allows the worker to perform resin welding while holding the welder in his hand,

and is constructed so that the welding member feeding apparatus 10 and hot air draft apparatus 11 are substantially integrated.

Next, the trough structure that is mounted on the construction outer surrounding body of the present invention in cases where this construction outer surrounding body is worked as a roof will be described with reference to Figs. 7 and 8. The mounting structure of this trough includes two types; first of all, in the first type, the trough member 6 is constructed from a trough main body 6a and an attachment part 6b. This trough member 6 is constructed from raw materials that are formed by constructing a thin metal sheet part m_1 and a synthetic resin film m_2 in layer form in the same manner as in the abovementioned construction sheet A. This trough main body 6 has a substantially square cross-sectional shape, and an attachment part 6b is integrally formed from the upper end of the side part of this trough main body part 6a. Furthermore, if at least the front surface of the attachment part 6b of the trough member 6 is covered with the abovementioned synthetic resin film m_2, it is not absolutely necessary that the side of the trough main body 6a be covered with this synthetic resin film m_2. In the attachment part 6b, at the upper end of this attachment part 6b, a substantially horizontal bent part is formed so as to protrude outward in

the lateral direction at the upper end of one side sheet in the lateral direction.

Furthermore, as is shown in Figs. 7 and 8B, a hanging part 1a is formed on one end of the construction sheet A in the longitudinal direction on the part that constitutes the eave so that this hanging part 1a is substantially perpendicular to the longitudinal direction of the main sheet 1. This hanging part 1a is bent so that this part is oriented downward on the eave end of the abovementioned main sheet 1 in the longitudinal direction, and forms substantially a right angle with the abovementioned main sheet 1. Furthermore, the hanging part 1a may also form an angle that is inside or outside a right angle (but near a right angle) with respect to the main sheet 1; this hanging part need not be oriented at precisely a right angle. An underlying member 7 for use in welding is disposed in the connection location between the eave end of the construction sheet A and the trough member 6. Like the abovementioned construction sheet A, this underlying member 7 for use in welding is also formed from a raw material in which a thin metal sheet part m_1 and a synthetic resin film m_2 are constructed in layer form, thus facilitating resin welding of the construction sheet A and trough member 6 as will be described later. However, it is not absolutely necessary that the raw material of the abovementioned

underlying member 7 for use in welding be formed from a thin metal sheet part m_1 and a synthetic resin film m_2.

As is shown in Figs. 7A and 7B, the cross-sectional shape of the underlying member 7 for use in welding is a substantially step-form shape. In concrete terms, this is formed as a step-form shape with two steps, and is formed by appropriately bending a metal sheet member. This underlying member 7 for use in welding is a member that is long in the longitudinal direction, and is disposed so that this member is perpendicular to the longitudinal direction of the abovementioned construction sheet A. Furthermore, as is shown in Figs. 7A and 7B, the attachment part 6b of the trough member 6 is disposed on the horizontal surface $7a_1$ of the central corner part 7a in a section perpendicular to the longitudinal direction of the underlying member 7 for use in welding, so that the hanging part 1a of the construction sheet A contacts the vertical surface $7a_2$.

Furthermore, the resin welding member 8 is also fused by resin welding to the synthetic resin film m_2 of the abovementioned underlying member 7 for use in welding, so that the hanging part 1a of the construction sheet A, the attachment part 6b of the trough member 6 and the underlying member 7 for use in welding are fastened by being fused together. Furthermore, in the connection location of the overlapped part 2 and overlapping part 3 of the construction

sheets A, A that are adjacent at the eave location, these parts are also fused (welded) by means of the resin welding member 8 to the portions of the overlapped part 2 and overlapping part 3 that are overlapped with the eave end, as shown in Fig. 7A.

As a result, the resin welding member 8 can close off the opening part between the overlapped part 2 and overlapping part 3 at the eave in a water-tight manner by the fusion (welding) of this resin welding member 8, so that this opening part is covered. In concrete terms, the area along the longitudinal direction of the overlapping location of the abovementioned overlapped part 2 and overlapping part 3 is fused (welded) by the resin welding member 8 to the corner part K and lower end T; furthermore, the overlapping tip end location of the abovementioned eave is sufficiently closed off by the resin welding member 8, and the resin welding member 8 is fused (welded) to the periphery of the eave on the opposite side from the abovementioned corner part K and lower end T. As a result, the water-tightness in the connection location between the overlapped part 2 and overlapping part 3 is secure.

Furthermore, the hanging part 1a and attachment part 6b are fused (welded)by the abovementioned resin welding member 8. Moreover, the upper end surface 7b on top of the corner part 7a of the underlying member 7 for use in welding is placed on the top surface part of the abovementioned underlying part 5,

and the lower end surface 7c in the lower part of the abovementioned corner part 7a is in a state of contact with the vertical surface of the abovementioned underlying part 5. Moreover, the trough main body 6a of the abovementioned trough member 6 may also be supported by a bracket 9 fastened to the underlying part 5 as shown in Fig. 7B. This bracket 9 is formed from a band-form metal sheet, and consists of a fastening part 9a that is fastened to the abovementioned underlying part 5, and a supporting part 9b that supports the abovementioned trough member 6. The abovementioned fastening part 9a is fastened to the abovementioned underlying part by means of drill screws, anchor bolts or the like, and the supporting part 9 provides support from the side of the undersurface of the trough member 6.

Furthermore, a second type of trough structure is a trough structure which is continuously formed so that the abovementioned trough member 6 and underlying member 7 for use in welding constitute an integral unit as shown in Figs. 8C and 8D. In this structure, in concrete terms, the location where the abovementioned attachment part 6b was formed is changed to the underlying member 7 for use in welding. This integrally formed underlying member 7 for use in welding is disposed on the abovementioned underlying part 5 in more or less the same manner as in the abovementioned first type. Furthermore, a state is produced in which the upper end

surface 7b of the top location of the underlying member 7 for use in welding is inserted between the construction sheet A and the underlying part 5, and the abovementioned hanging part 1a and the horizontal surface $7a_1$ of the corner part 7a of the underlying member 7 for use in welding are fused (welded) via the resin welding member 8.

Fig. 4A shows the second type of construction sheet A. As is shown in Figs. 4B and 4C, this is a sheet in which the shapes of the overlapped part 2 and overlapping part 3 on both ends of the main sheet 1 in the lateral direction are formed substantially as inverted "U" shapes. Furthermore, a fastening part 4 is formed as a continuation of the overlapped part 2. Moreover, as in the case of the construction sheet A of the abovementioned first type, the overlapped part 2 comprises an inside part 2a and an outside part 2b, and the overlapping part 3 also comprises an inside part 3a and outside part 3b.

In the lower part of the inside part 2a of the overlapped part 2, an engaged part 2c is formed so that this engaged part is recessed inside the abovementioned overlapped part 2 formed with an inverted "U" shape. Similarly, the engaging part 3c from the lower end of the outside part 3b so that this engaging part is recessed into a shallow "V" shape toward the inside of the overlapping part 3 formed with an inverted "U" shape. This second type is devised so that the engaged state

is slightly shallower than that of the engaged part 2c and engaging part 3c of the abovementioned first type, thus making it possible to reduce the pressing force required in the engagement work. Furthermore, the fastening part 4 is continuously formed from the lower end of the outside part 2b of the abovementioned overlapped part 2.

Fig. 5A shows a third type of construction sheet A. As is shown in Figs. 5B and 5C, this is a sheet the shapes of the engaged part 2c of the overlapped part 2 and the engaging part 3c of the overlapping part 3 are not formed. Specifically, in this sheet, the overlapping part 3 is merely overlapped with the overlapped part 2, and the synthetic resin films m_2, m_2 are then fused to each other using only the resin welding member 8. In this third type of construction sheet A, as in the first and second types, the overlapped part 2 comprises an inside part 2a and an outside part 2b, and the overlapping part 3 also comprises an inside part 3a and an outside part 3b. Furthermore, the abovementioned fastening part 4 is continuously formed from the lower end of the outside part 2b of the abovementioned overlapped part 2.

Fig. 6A shows a fourth type of construction sheet A. As is shown in Figs. 6B and 6C, this sheet is construction from a construction sheet A and a suspension element 6'. In this construction sheet A, an overlapped part 2 and an overlapping part 3 are respectively formed on both sides of a main sheet 1

in the lateral direction. Furthermore, as described above, the main sheet 1, overlapped part 2 and overlapping part 3 are covered by a synthetic resin film m_2. The overlapped part 2 is formed in the shape of a vertical sheet, and the overlapping part 3 consists of an inside part 3a and an outside part 3b; the cross section is formed substantially in an inverted "U" shape by this inside part 3a and outside part 3b.

Furthermore, as is shown in Fig. 6B, the suspension element 6' is constructed from a fastening base part 6a' and a retaining part 6b', and this retaining part 6b' is formed with a cross section that has substantially an inverted "U" shape. Moreover, the overlapped part 2 of the construction sheet A is fastened by the retaining part 6b' of the abovementioned suspension element 6', through-holes $6a_1'$ are bored in the fastening base part 6a' of the suspension element 6', and fastening fittings 12 such as screws or the like are passed through the through-holes $6a_1'$ and fastened to the underlying part 5. Furthermore, the overlapping part 3 is overlapped with the overlapped part 2, and resin welding is performed on the main sheet 1 in the vicinity of the corner part K, and as far as the vicinity of the lower part (lower end T) of the abovementioned overlapping part 3.

Furthermore, in cases where the construction outer surrounding body is worked as a roof, there may be instances, as shown in Fig. 7A, in which rising members 13 are disposed

on the horizontal upper ends of the lined-up construction sheets A, A, ... In such a case, the joint structure of the abovementioned rising members 13 has a configuration in which the horizontal upper ends of the areas of overlapping between the overlapped parts 2 and overlapping parts 3 are in close proximity or substantially in a state of contact with the abovementioned rising members 13, and the corner locations formed by the overlapped parts 2, overlapping parts 3 and rising members 13 are fused by performing resin welding via the abovementioned resin welding member 8.

Furthermore, like the construction sheets A, the abovementioned rising members 13 are formed by a thin metal sheet part m_1 and a synthetic resin film m_2 disposed in layer form; naturally, the synthetic resin film m_2 faces the horizontal upper sides of the abovementioned overlapped parts 2 and overlapping parts 3. Furthermore, the synthetic resin film m_2 of the rising members 13 and the synthetic resin film m_2 of the overlapped parts 2 and overlapping parts 3 are fused via the resin welding member 8, thus making it possible to form a secure waterproof structure. The rising member 13 are used as wall surfaces or the like formed on the end parts of the horizontal upper side of the roof.

Furthermore, as was described above, it is desirable that the construction sheets A, trough members 6 and underlying parts 7 for use in welding be used with the synthetic resin

film m_2 positioned on the top surface side so that mutual fusion (welding) is facilitated. Specifically, in the joints between adjacent construction sheets A, A, the system is arranged so that the synthetic resin film m_2 is positioned on the top surface sides of the overlapped parts 2 and overlapping parts 3; the synthetic resin film m_2 is positioned on the top surface sides of the construction sheets A, trough members 6 and underlying parts 7 for use in welding so that these respective members are easily fused.

As is shown in Fig. 2, the construction sheets A are formed from a raw material in which a thin metal sheet m_1 and a synthetic resin film m_2 are constructed in layer form, and each of these construction sheets A consists of a main sheet 1, an overlapped part 2 which is formed on one end of this main sheet 1 in the lateral direction, an overlapping part 3 which is formed on the other end of the abovementioned main sheet 1 in the lateral direction, and which can overlap with the abovementioned overlapped part 2, and a fastening part 4 which is formed in a substantially flat shape from the outside end of the abovementioned overlapped part 2.

A plurality of construction sheets A, A, ... are lined up side by side on an underlying part 5. As is shown in Fig. 2E, the fastening part 4 of one adjacent construction sheet A is fastened to the underlying part 5 by means of fastening fittings 12 such as drill screws or the like, a portion of the

main sheet 1 near the overlapping part 3 of another adjacent construction sheet A is placed on this fastening part 4, and the overlapping part 3 is overlapped with the abovementioned overlapped part 2. Then, as is shown in Fig. 3C, resin welding is performed via the resin welding member 8 from the vicinity of the outsides (lower ends T) of the overlapping parts 3 of both adjacent construction sheets A, A to the vicinity of the inside corner parts (corner parts K) of the overlapped parts 2, so that the abno synthetic resin films m_2, m_2 of the adjacent construction sheets A, A are fused together with the resin welding member 8, and an outer surrounding body such as a roof, wall or the like is formed.

In the construction outer surrounding body of the present invention, as was described above, each construction sheet A has a thin metal sheet part m_1 and a synthetic resin film m_2 that are constructed in layer form; furthermore, each of these construction sheets A has a main sheet 1, an overlapped part 2 which is formed on one end of this main sheet 1 in the lateral direction, an overlapping part 3 which is formed on the other end of the abovementioned main sheet 1 in the lateral direction, and which can overlap with the abovementioned overlapped part 2, and a fastening part 4 which is formed in a substantially flat shape from the outside end of the abovementioned overlapped part 2.

Furthermore, the area in the vicinity of the overlapping part 3 of one adjacent construction sheet A is placed on the fastening part 4 of another adjacent construction sheet A, the overlapping part 3 is overlapped with the abovementioned overlapped part 2, and the synthetic resin films m_2, m_2 of the adjacent construction sheets A, A can be fused (resin-welded) and connected via the resin welding member 8 from the vicinity of the outer ends of the overlapping parts 3 of both construction sheets A, A to the vicinity of the inside corner parts of the overlapped parts 2, so that the work is extremely efficient, and can be performed quickly and easily. Furthermore, since the synthetic resin films m_2, m_2 of the adjacent construction sheets A, A are fused (welded) to each other by means of the resin welding member 8, a body with extremely good waterproofing and water-tightness can be obtained.

Furthermore, as was described above, since the abovementioned fastening part 4 is continuously formed from the outside end of the overlapped part 2, the fastening of this fastening part 4 to the underlying part 5 or the like by means of fastening fittings 12 such as drill screws or the like can easily be accomplished, and since this fastening part 4 is also covered and hidden by a portion of the main sheet 1 near the overlapping part 3 of the other adjacent construction sheet A, an extremely clean state can be obtained in terms of

external appearance. As a result, mounting members such as suspension elements or the like become unnecessary on the construction sheets A, so that the number of parts required can be greatly reduced.

Furthermore, the adjacent construction sheets A, A are connected by fusion of the synthetic resin films m_2, m_2 via the resin welding member 8; here, since the resin welding member 8 and synthetic resin films m_2 are both synthetic resins, these parts will melt at a low temperature, so that a high temperature that would cause deformation due to local thermal strain in a metal is unnecessary. Accordingly, the constructions sheets A themselves can be given a good finish with no occurrence of deformation caused by thermal strain.

Furthermore, as a result of the fact that [i] an engaged part 2c is formed in the abovementioned overlapped part 2, [ii] an engaging part 3c is formed in the overlapping part 3 in a position corresponding to the abovementioned engaged part 2c, and [iii] the abovementioned engaged part 2c and engaging part 3c are engaged and fastened, the working efficiency can be improved.

Specifically, by engaging the abovementioned engaged part 2c and engaging part 3c until the fusion of the synthetic resin films m_2, m_2 to each other by resin welding via the resin welding member 8 in the lined-up construction sheets A, A, ... is completed, it is possible to maintain the overlapped state

of the overlapped parts 2 and overlapping parts 3, so that stability of positioning and of the working operation can be obtained. As a result, safe work can be performed extremely accurately and efficiently. Furthermore, as a result of the formation of the overlapped parts 2 and engaging parts 3c, the following advantage is also obtained: namely, the cross-sectional strength of the area of overlapping between the overlapped parts 2 and overlapping parts 3 can be improved.

Furthermore, as a result of a construction surrounding body being constructed in which the eave locations on the end parts of the abovementioned construction sheets A in the longitudinal direction and a trough member 6 formed by constructing a thin metal sheet part m_1 and a synthetic resin film m_2 in layer form are fused by the abovementioned synthetic resin film m_2 via the abovementioned resin welding member 8, the water-tight mounting of the eave and trough members 6 in the longitudinal direction of the construction sheets A, A, ... can be greatly simplified.

Specifically, like the construction sheets A, the abovementioned trough member 6 is also a member in which a thin metal sheet part m_1 and a synthetic resin film m_2 are constructed in layer form, and the eave end parts of the abovementioned construction sheets A and the respective trough members 6 can be fused (welded) by resin welding via the resin welding member 8. As a result, the spaces between the eave

end parts in the longitudinal direction of the construction sheets A and the trough members 6 are completely water-tight, so that rain water can be securely introduced into the trough members 6.

Next, the manufacturing apparatus B will be described. As is shown in Figs. 9A and 9B, this manufacturing apparatus B is constructed mainly from a resin welder part B_1 consisting of a welding member feeding apparatus 10 and a hot air draft apparatus 11, a welder receiving stand 21 that supports this welder part B_1, a driving part 16, a running part 17, a finishing roll part 20, a car part 19 and the like. This car part 19 is formed in a rectangular flat plate shape. The abovementioned resin welder part B_1, driving part 16 and the like are mounted on the upper surface of the car part 19; furthermore, the running part 17 is mounted on the undersurface side of the car part 19.

As is shown in Fig. 10B and Figs. 11A and 11B, the abovementioned running part 17 is constructed from running wheels 17a and axles 17b that are used to cause the car part 19 to run; these axles 17b are mounted via bearings on the undersurface of the abovementioned car part 19 in locations on both ends in the forward-rearward direction, and the running wheels 17a are mounted on these axles 17b. As is shown in Fig. 9 and 10, the running wheels 17a consist of front wheel parts $17a_1$ and rear wheel parts $17a_2$.

The respective front wheel parts $17a_1$ and rear wheel parts $17a_2$ of the running part 17 are rotationally driven via the abovementioned driving part 16. As is shown in Fig. 9B, this driving part 16 consists of a driving motor 16a and a transmission part 16b, and a chain or the like is used as the transmission part 16b. Furthermore, transmission receiving parts 17c such as driven sprockets or the like are mounted on the respective axles 17b, 17b of the abovementioned front wheel parts $17a_1$ and rear wheel parts $17a_2$, and a transmission part 16b such as a chain or the like is mounted between a driving member 16c such as a driving sprocket or the like mounted on the abovementioned driving motor 16a, and the abovementioned transmission receiving parts 17c, so that a rotational force is transmitted to the front wheel parts $17a_1$ and rear wheel parts $17a_2$ from the driving part 16.

In this way, the system is arranged so that the front wheel parts $17a_1$ and rear wheel parts $17a_2$ can be caused to rotate independently in the same direction by the via the driving part 16. The constructions of this driving part 16 and running part 17 are not limited to the constructions described above. In order to obtain a structure that supports the weight of these apparatuses, the abovementioned car part 19 has the strength of a relatively thick part; in actuality, metal plate or the like are used. Furthermore, besides the abovementioned independent driving system for the front wheel

parts $17a_1$ and rear wheel parts $17a_2$, it would also be possible to use a driving system involving the front wheel parts $17a_1$ alone or a driving system involving the rear wheel parts $17a_2$ alone.

Next, as is shown in Figs. 9A and 9B, the resin welder part B_1 is constructed from a welding member feeding apparatus 10 and a hot air draft apparatus 11 as described above. This welding member feeding apparatus 10 has the function of feeding out the molten resin welding member 8 to specified locations, and is an apparatus in which a feed-out part 10b is disposed on the tip end of a holder 10a. A resin welding member 8 is accommodated inside this holder 10a; the resin welding member 8 is carried to the location of the feed-out part 10b, and this resin welding member 8 is extruded from this feed-out part 10b, so that resin welding is performed in specified locations while the resin welding member 8 is heated by a hot air draft sprayed from the spray nozzle 11a of the abovementioned hot air draft apparatus 11.

The resin welder part B_1 is supported on a welder receiving stand 21 mounted on the car part 19. Furthermore, as is shown in Figs. 9 and 10, the resin welder part B_1 is connected to the welder receiving stand 21 by means of a pivot-supporting connecting member 22 so that the resin welder part B_1 is free to pivot on the vertical plane with respect to the welder receiving stand 21, thus allowing this resin welder

part B_1 to be freely set in an appropriate manner in vertical and horizontal positions. In the abovementioned pivot-supporting connecting part 22, the resin welder part B_1 and the welder receiving stand 21 are connected via a shaft or the like so that these parts are free to pivost. A mechanism may also be provided which is devised so that when the abovementioned resin welder part B_1 is caused to pivot with respect to the welder receiving stand 21, an appropriate resistance force is generated against the force that causes the pivoting motion so that stabilized operating characteristics are obtained.

Furthermore, during the resin welding operation, the abovementioned resin welder part B_1 is set in a substantially vertical state. Furthermore, the resin welder part B_1 can be freely raised or lowered with respect to the welder receiving stand 21, so that the height position of the spray nozzle 11a of the hot air draft apparatus 11 can be adjusted, thus making it possible to set the position of the spray nozzle 11a at a desired height as shown in Fig. 10A. The welder receiving stand 21 is mounted on the abovementioned car part 19. Furthermore, when the manufacturing apparatus B is not being used, or prior to the initiation of the resin welding operation or the like, the resin welder part B_1 can be set in a horizontal state as shown in Fig. 10B.

As a result, important locations such as the location of the spray nozzle 11a of the resin welder part B_1 and the like can be protected. Furthermore, even when the manufacturing apparatus B is disposed in the working location, the car part 19 can easily be disposed in a specified position by placing the resin welder part B_1 in a horizontal state. Then, efficient planning work can be accomplished by setting the resin welder part B_1 in a vertical state after it has been confirmed that the car part 19 has been disposed in an accurate position, and performing a fine adjustment of the height of the spray nozzle 11a.

As is shown in Figs. 12A through 12C, Fig. 13 and the like, a feed-out nozzle 10c is mounted in the feed-out part 10b of the welding member feeding apparatus 10. As is shown in Fig. 12A, the feed-out part 10b has a block shape, and is formed substantially in the shape of a triangular prism. A feed-out part opening $10b_2$ is formed in the inclined surface part $10b_1$. A feed-out nozzle 10c (described later) is disposed on the inclined surface part $10b_1$, and, as is shown in Fig. 13A, when the resin welder part B_1 is set in a state that allows welding operations, this nozzle substantially faces the locations of the corner parts K in the connection locations between the overlapping parts 3 and overlapped parts 2 of the construction sheets A, A (described later).

Furthermore, the corner parts K in the connection locations (hereafter referred to as "connecting parts") of the adjacent construction sheets A, A are filled with the resin welding member 8, and the surface of the resin welding is finished with the molding surface $10c_1$ in a well-ordered state. The feed-out nozzle 10c is connected to this inclined surface part $10b_1$. This feed-out nozzle 10c is formed with a substantially triangular cross-sectional shape, and a molding surface $10c_1$ and a resin jet opening $10c_2$ are formed on the tip end portion of this feed-out nozzle 10c. This molding surface $10c_1$ presses against the resin welding member 8 that jets from the abovementioned resin jet opening $10c_2$ and is caused to fill the connection location between the abovementioned overlapping part 3 and overlapped part 2; the molding surface $10c_1$ cleanly molds the surface of the resin welding member 8 with the movement of the abovementioned car part 19, and has the function of adjusting this surface.

As is shown in Fig. 12A and Fig. 13, the molding surface $10c_1$ has a polyhedral shape. In concrete terms, this molding surface consists of three flat surfaces; a resin jet opening $10c_2$ is formed in the central surface, and the system is arranged so that the resin welding member 8 that is caused to jet in a molten state from the resin jet opening $10c_2$ is pressed against the connection location between the abovementioned overlapping part 3 and overlapped part 2 by the

molding surface $10c_1$, and is thus molded into a flat surface so that a good finished surface is obtained.

In cases where the molding surface $10c_1$ is formed as a part consisting of three surfaces, the central surface has the role of adjusting the surface of the resin welding member 8 that is melted and caused to fill the locations of the corner part K of the abovementioned overlapped part 2 and the lower end T of the overlapping part 3 so that an inclined surface is formed as shown in Fig 13A. Furthermore, the surface that is adjacent to the central surface of the abovementioned molding surface $10c_1$ on the upper side molds the molten resin welding member 8 so that a surface that is substantially perpendicular with respect to the locations of the corner part K of the abovementioned overlapped part 2 and lower end T of the overlapping part 3 is obtained, while the surface that is adjacent to central surface on the lower side has the role of pressing the molten resin welding member 8 so that a surface that is substantially parallel to the main sheet 1 of the abovementioned construction sheet A is obtained.

As is shown in Fig. 14A, the molding surface $10c_1$ may also be formed as a circular arc form surface. Furthermore, in cases where the molding surface $10c_1$ is formed as a circular arc form surface, the finished surface of the molten resin welding member 8 is a circular arc form surface as shown in Fig. 14B. These various types of molding surfaces $10c_1$ may

also be subjected to Teflon (registered trademark) working, so that the molten resin welding member 8 tends not to adhere to the molding surfaces. This feed-out nozzle 10c is freely detachable with respect to the abovementioned feed-out part 10b, and is fastened by means of fastening fittings such as screws, bolts or the like.

As is shown in Figs. 12B, 12C and 13, a pressing part 18 is mounted on the abovementioned feed-out part 10b if necessary. This pressing part 18 presses one of the adjacent construction sheets A against the underlying part 5 in case where resin welding is performed in the corner parts K in the connecting parts j of the abovementioned adjacent construction sheets A, A, and thus prevents a deviation in the position of the construction sheet A in the resin welding work. In this pressing part 18, a pressing roll 18b is mounted on a pressing frame 18a. This pressing frame 18a is detachably mounted on the feed-out part 10b by means of fastening fittings such as screws, bolts or the like. Furthermore, the pressing roll 18b presses the main sheet 1 of the abovementioned construction sheet A. The pressing frame 18a is formed in an "L" shape as shown in Fig. 13B (which shows the pressing frame in a plan view).

Furthermore, the abovementioned feed-out nozzle 10c is mounted on the car part 19 via a welder receiving stand 21. The resin welder part B_1 is mounted on the welder receiving

stand 21 so that the height of this resin welder part can be adjusted in the vertical direction. The car part 19 is formed in a flat plate form in the longitudinal direction, and can be caused to run by means of the driving part 16 and running part 17. A hot air draft in blown onto the locations of the overlapped parts 2 and overlapping parts 3 from the spray nozzle 11a of the hot air draft apparatus 11, and these locations are filled with the resin welding member 8 from the abovementioned welding member feeding apparatus 10 while being heated to a high temperature (see Fig. 13A).

In this case, as is shown in Fig. 13A, the system is arranged so that the hot air draft from the spray nozzle 11a strikes the corner parts K of the abovementioned overlapped parts 2 and the lower ends T of the overlapping parts 3, so that the molten resin welding member 8 can fill the locations of the corner parts K and the locations of the lower ends T. Furthermore, the resin welding member 8 fuses with the respective synthetic resin films m_2 of the abovementioned overlapped parts 2 and overlapping parts 3, so that the resin welding member 8 and the synthetic resin films m_2 are fastened into an integral unit, thus making it possible to form the location of the overlapping area between the overlapped parts 2 and overlapping parts 3 into a waterproof structure.

Furthermore, as is shown I Figs. 10B, 15A and the like, a finishing roll part 20 equipped with a tightening roll 20a and

a supporting roll 20b is mounted on the undersurface side of the car part 19. As is shown in Figs. 15B and 15C, the abovementioned finishing roll part 20 tightens the overlapped parts 2 and overlapping parts 3 of the adjacent construction sheets A, A; the abovementioned tightening roll 20a supports the outside part 3b of the overlapping part 3, and the supporting roll 20b presses against the inside part 3a.

The tightening roll 20a and supporting roll 20b are driven by an elastic member 20d and guide shaft 20e so that these parts approach each other. Furthermore, the supporting roll 20b can be forcibly separated from the abovementioned tightening roll 20a by means of an operating knob part 20c. This tightening roll 20a and supporting roll 20b perform connection work between the overlapping parts 3 and overlapped parts 2, and also play a role in stabilizing the running of the car part 19. Furthermore, in regard to the tightening structure in the connecting parts j, there may also be cases in which the abovementioned tightening roll 20a supports the inside parts 3a of the overlapping parts 3, and the supporting roll 20b presses against the outside parts 3b.

Furthermore, as is shown in Figs. 15A, 15B and 15C, guide rings 23, 23 are disposed on the car part 19 in locations on both ends in the forward-rearward direction adjacent to the abovementioned supporting roll 20b. These guide rings 23, 23 rotate while being carried on the top parts of the connecting

parts j between the overlapped parts 2 and overlapping parts 3 of the adjacent construction sheets A, A, and have a pulley shape in which the diameter is reduced in the center in the lateral direction (direction of thickness). The car part 19 can be caused to move accurately along the connecting parts j by these guide rings 23, 23. Furthermore, the guide rings 23 may also be formed with a structure in which bearings allow free movement in the horizontal direction.

Next, the performance of resin welding by the manufacturing apparatus B will be described. First, the abovementioned construction sheets A, A, ... are placed on the underlying part 5, and the overlapped parts 2 and overlapping parts 3 of the adjacent construction sheets A, A are overlapped and connected. The guide rings 23, 23 mounted on both ends of the abovementioned manufacturing apparatus B in the forward-rearward direction are disposed in the abovementioned connection location, and the front wheel parts $17a_1$ and rear wheel parts $17a_2$ are disposed on the main sheet 1 of the construction sheet A (see Fig. 9A). Next, the driving part 16 is started so that the front wheel parts $17a_1$ and rear wheel parts $17a_2$ are caused to rotate, thus causing the manufacturing apparatus B to run, and resin welding is performed in the abovementioned overlapped connection location by the resin welder part B_1 mounted in the manufacturing apparatus B.

This manufacturing apparatus B can be caused to move along the longitudinal direction of the connecting parts j between the overlapped parts 2 and overlapping parts 3 by the abovementioned guide rings 23, 23, so that resin welding can be performed in a favorable state in these connecting parts j, thus making it possible to obtain a uniform finish in the welded surface (see Fig. 13A).

In the manufacturing apparatus B of the present invention, the car part 19 on which the resin welder part B_1 is mounted runs via the driving part 16 and running part 17; as a result, merely by setting the position where the resin welder part B_1 is to fill the connection locations (connecting parts j) between the abovementioned adjacent construction sheets A, A with the molten resin welding member 8, it is possible to achieve substantially accurate and uniform filling with the molten resin welding member 8 by the running of the car part 19, so that the finish can also be made extremely clean. This finish is substantially the same as that obtained by an experienced worker.

Furthermore, in the apparatus of the present invention, as a result of the provision of a resin welder part B_1 constructed from a car part 19 equipped with a running part 17 that is caused to rotate by the abovementioned driving part 16, a welding member feeding apparatus 10 that feeds out the molten resin welding member 8, and a hot air draft apparatus

11 that heats the connection locations (connecting parts j) between the abovementioned adjacent construction sheets A, A, favorable resin welding can be performed in the connection locations (connecting parts j) between the adjacent construction sheets A, A, so that these connection locations can be formed as parts that have more secure water-tightness and air-tightness.

Specifically, in the manufacturing apparatus B of the present invention, the synthetic resin film m_2 in the connection locations (connecting parts j) between the adjacent construction sheets A, A is melting by the hot air draft apparatus 11, and the resin welding member 8 that is extruded from the welding member feeding apparatus 10 is integrally mixed with the abovementioned melted synthetic resin film m_2; as a result, more secure water-tightness and air-tightness can be obtained. Furthermore, the manufacturing apparatus B of the present invention has a structure in which the car part 19 runs by means of a driving part 16 and a running part 17, and comprises a welding member feeding apparatus 10 that feeds out the resin welding member 8, and a hot air draft apparatus 11 that heats the connection locations (connecting parts j) between the adjacent construction sheets A, A, on the abovementioned car part 19.

Moreover, since resin welding is performed while the manufacturing apparatus B is caused to run by the

abovementioned driving part 16 and running part 17, the finish of the resin welding along the running direction can be made uniform, so that an extremely good finish can be obtained. Furthermore, since the abovementioned resin welding member 8 and synthetic resin film m_2 are both synthetic resins, these materials can be melted at a relatively low temperature, so that the following advantage is also obtained: namely, a good finish can be obtained without causing any deformation due to thermal strain in the constructions sheets A themselves.

Furthermore, by mounting a connecting roll part comprising a tightening roll 20a that tightens the connection locations of the adjacent construction sheets A, A, and a supporting roll 20b, on the abovementioned car part 19, it is possible to fill the connection locations between the adjacent construction sheets A, A with the molten resin welding member 8 while tightening these connection locations, so that a good finish can be obtained. Specifically, the abovementioned connecting roll part 20 comprises a tightening roll 20a and a supporting roll 20b, and the car part 19 moves while the abovementioned connection location (overlapping connection location between the overlapped parts 2 and overlapping parts 3) is tightened by this tightening roll 20a and supporting roll 20b. As a result, the connecting locations (connecting parts j) between the overlapped parts 2 and overlapping parts 3 of the adjacent construction sheets A, A are filled with the

molten resin welding member 8 while these connection locations are tightened, so that resin welding can be performed in a much more favorable state.

Furthermore, in the apparatus of the present invention, if guide rings 23, 23 that are placed on the top parts of the connection locations between construction sheets A, A that are adjacent in the forward-rearward direction are disposed on the abovementioned car part 19, the manufacturing apparatus B can be caused to move accurately along the connection locations (connecting parts j) between the adjacent construction sheets A, A, so that the filling with the molten resin welding member 8 is much more accurate, thus making it possible to obtain a good finish. Here, guide rings 23, 23 are disposed in the forward-rearward direction of the car part 19, and these guide rings 23, 23 are disposed in the connection locations (connecting parts j) between the adjacent construction sheets A, A, so that the connection locations (connecting parts j) between the abovementioned construction sheets A, A act as rails. As a result, the manufacturing apparatus B can be caused to move accurately along the connection locations (connecting parts j), so that the resin welding can be cleanly and uniformly adjusted, thus making it possible to obtain a uniform finish.

Furthermore, in the apparatus of the present invention, the abovementioned resin welder part B_1 can be freely set in an

appropriate position along the vertical direction, so that the planning of the resin welding work performed by the manufacturing apparatus B can be carried out with good efficiency. Specifically, the abovementioned resin welder part B_1 can be freely set in an appropriate position along the vertical direction. As a result, an extremely accurate position can be filled with the molten resin welding member 8 by first setting the resin welder part B_1 in a high position, and then lowering the abovementioned resin welder part B_1 to the appropriate position following fine adjustment of the position of the car part 19 (without causing the tip end locations of the welding member feeding apparatus 10 and hot air draft apparatus 11 to contact the connection location) when the manufacturing apparatus B is disposed in the connection location between the abovementioned adjacent construction sheets A, A, and performing resin welding.

Furthermore, in the apparatus of the present invention, since a feed-out nozzle 10C that feeds out the abovementioned resin welding member 8 to the connection location (connecting part j) between the abovementioned adjacent construction sheets A, A is mounted in the welding member feeding apparatus 10 of the abovementioned resin welder part B_1, and a molding surface $10c_1$ is formed in this feed-out nozzle 10c, the surface of the resin welding can be adjusted to a uniform surface.

Specifically, the resin welding member 8 in a molten state that is extruded from the feed-out nozzle 10c fills the connection location (connecting part j) between the abovementioned adjacent construction sheets A, A, and the connection location (connecting part j) is at the same time pressed by the molding surface $10c_1$, so that the surface of the resin welding is uniform; furthermore, since the molding surface $10c_1$ moves in the longitudinal direction of the connection location (connecting part j) as the car part 19 moves, the surface of the resin welding member 8 that fills the connection location (connecting part j) can be formed with a flat, uniform surface state.

Furthermore, in the apparatus of the present invention, since a pressing part 18 that presses the main sheets 1 in the vicinity of the connection location between the adjacent construction sheets A, A is mounted in the feed-out part 10b of the abovementioned welding member feeding apparatus 10, the main sheets 1 in the vicinity of the connection location between the adjacent construction sheets A, A can be pressed by this pressing part 18, so that the area in the vicinity of the connection location (connecting part j) between the adjacent construction sheets A, A can be stabilized in the resin welding work, thus tending to prevent deviation in the vertical direction from being generated in the adjacent

construction sheets A, A, so that resin welding with an extremely good finish can be performed.

Furthermore, since the areas in the vicinity of the connecting parts j of the main sheets 1 are pressed by the pressing part 18, any steps that might be created in the vicinity of the connecting parts j of the main sheets 1 can be eliminated or reduced before these steps are subjected to resin welding, so that favorable resin welding can be performed. Furthermore, even in cases where field sheets or the like are in a non-uniform state, good running of the apparatus can be maintained by means of the pressing part 18.

Furthermore, in the apparatus of the present invention, the running wheels 17a of the abovementioned running part 17 consist of front wheel parts $17a_1$ and rear wheel parts $17a_2$, and a construction outer surrounding body manufacturing apparatus is constructed in which both the abovementioned front wheel parts $17a_1$ and rear wheel parts $17a_2$ are rotationally driven by the abovementioned driving part 16; accordingly, the resin welding can be given a favorable finish. Specifically, the manufacturing apparatus B is an apparatus in which the front wheel parts $17a_1$ and rear wheel parts $17a_2$ of the running wheels 17a are independently driven, so that stable and accurate running can be accomplished.

Furthermore, the movement speed of the resin welding member feed-out nozzle 10c is also a constant and stable speed,

so that amount of filling with the fed-out resin welding member 8 can be made uniform in all positions. Accordingly, the resin welding can be given a good finish. Moreover, even if the main sheets 1 of the construction sheets A do not have a flat surface, but are rather surfaces with some indentations and projections, or surfaces that are in an irregular state with respect to the running direction, the effects of these indentations and projections or irregularities can be avoided, so that running at a stable constant speed can be maintained, since the front wheel parts $17a_1$ and rear wheel parts $17a_2$ of the running wheels 17a are driven independently.

INDUSTRIAL APPLICABILITY

The present invention can be utilized in outer surrounding bodies such as roofs, walls or the like worked as construction sheets in which the surface or a thin metal sheet is covered by a film made of a synthetic resin. In particular, good waterproofing and water-tightness can be obtained in the connection locations between construction sheets, and in the mounting locations of members such as trough members, and an extremely favorable finish and working characteristics can be obtained. Moreover, the manufacturing apparatus of the present invention makes it possible to obtain an extremely good finish in terms of waterproofing and water-tightness regardless of the experience of the worker.